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Abstract *In this paper we develop a framework for analyzing negotiation processes in networked innovation, and apply it in infrastructure construction. The paper departs from the question: Why do technological innovative concepts sometimes emerge and diffuse while at other times they 'congest'? An explanation is found in negotiation processes at different levels in networks, as technological innovations increasingly emerge in heterogeneous networks. We contribute to theory by focusing on the process of negotiation in networks (instead of on network structure), and by showing and explaining how negotiations can both contribute to and adjourn networked innovation processes.*

Keywords: Embeddedness; Infrastructure technology; Innovation processes; Negotiation; Networked innovation

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1. Introduction

Getting innovations diffused in a wider environment proves highly complex, and often even impossible (European Commission, 1995; Poyago-Theotoky et al., 2002; Siegel et al., 2003; Stevens & Burley, 1997). Existing theory provides abundant explanations for how technological innovations diffuse and why this is often so complicated: Adoption is achieved through communication, proximity and motivation (Beise, 2004; Rogers, 2003), institutions and market structures have a role in channeling new technologies to users (Dacin et al., 2002; DiMaggio & Powell, 1983; Feldman & Pentland, 2003; Scott, 2001), and institutional entrepreneurs can give legitimacy to a new development or change (Garud et al., 2002; Greenwood & Suddaby, 2006). Although these and other current literature have all proved to deliver valuable insights, they do not explicitly focus on two important characteristics of current innovation processes. One is that networks increasingly are the locus of innovation (Chesbrough, 2003; Powell et al., 1996; Sawhney & Prandelli, 2000; Scarbrough & Swan, 2005; Tuomi, 2002). Secondly, these networks can be characterized as heterogeneous, in which different types of interdependent organizations collaborate, while each has different, sometimes even competing interests (Leydesdorff & Meyer, 2006; Siegel et al., 2003; Swan & Scarbrough, 2005).

Consequently, innovations come about in heterogeneous networks where organizations need to work together and align their differences, but where none of them has the absolute or natural power to guide the process of change on its own. As a result, the success of technological innovation increasingly depends on the collaborating, networking and political skills of organizations (Powell et al., 1996; Santoro & Gopalakrishnan, 2001). Additionally, recent studies show that transfer of knowledge necessary for innovation between individuals from different professional backgrounds and interests often turns out to be problematic, causing non-spread of innovation (Ferlie et al., 2005). Negotiation processes, background and interests should therefore get explicit attention when developing theory for understanding networked innovation processes. Our aim in this paper is to improve understanding of why innovation and its

diffusion are so difficult in heterogeneous networks and what the role of negotiation is in this process of networked innovation.

Whereas a few papers have stressed the importance of negotiation or politics in networked innovation processes (Beamish & Biggart, 2005; Hislop et al., 2000; Pettigrew, 1987; Swan & Scarbrough, 2005; Wijen & Duysters, 2005), it is not clear yet how negotiations take place and influence networked innovation. Understanding this is essential because negotiation processes might explain the whimsical path of innovation diffusion, or the lack thereof (Ferlie et al., 2005; Wijen & Duysters, 2005). It would bring innovation theory to a deeper understanding of the dynamics of innovation processes and of why networked innovations do not easily diffuse. In this paper we therefore develop a framework that focuses on the process and the 'capitals' (resources) that are developed and used as a source of power, as well as on the multilevel network setting in which the negotiations take place. We aim to contribute to innovation theory with a framework that helps 'opening up the black box' of negotiation in networked innovation, and helps describing, conceptualizing, and thus understanding the social dynamics that influence the direction and outcome of such endeavors.

In order to develop our framework for understanding negotiation in the process of networked innovation, we conducted a case study in the field of infrastructure construction. Between 1999 and 2004, a consortium of people from various organizations created a prototype of (a part of) a floating road infrastructure. This all took place in a project that was financially supported by the government, in the form of an open design competition. Within the current construction of contracts, the consortium can be considered as the executing contractor of a governmental project. The story in this paper addresses the 'winning consortium': Aluminum Network (a pseudonym). The goal of this study is not to prove or test our theoretical framework as such, but to illustrate it, show its conceptual use and to (further) develop networked innovation theory. The case was chosen because it shows that innovations do not always easily emerge and diffuse and explains why this is. The following fragment introduces our case of 'the floating road' and offers an example of the arena in which the negotiations take place.

The Aluminum Network consists of architects, researchers, constructors, engineers and consultants, who knew each other from earlier cooperation in projects where they built aluminum constructions. In the floating road project they aim to develop and construct a floating road in order to solve two main (infrastructural) problems in the Netherlands, where a main part of the country is in fact a densely populated river-delta and lies below sea-level: Conventional roads are too full (traffic jams) and water needs to be managed in an innovative way (flood risks). In particular, flexible systems are required that combine multiple functions of land/space; using floating roads in existing waterways or on watery soil. Out of several networks, Aluminum Network is the one that recently succeeded in designing and constructing such a floating road; a radical technological innovative concept.

When the road was constructed (in 2004), the actors involved in the project were very enthusiastic about the highly aesthetic design made by the Aluminum Network. Currently however, the diffusion of their concept of a floating road seems to stagnate, even though other floating concepts, such as floating glasshouses, houses and foundations, seem on the rise. After successfully testing the floating road, no genuine application was found for it for over three years. Now, in a time where traffic jams and flood risks are stringent, not only Aluminum Network participants, but also the Dutch government ask themselves: Why is it so hard to diffuse floating roads and why aren't we using them at a large scale yet?

The framework that we develop throughout this paper helps explaining why and how networked innovation sometimes diffuses in a larger environment, while at other times it adjourns: How do negotiation processes in networks in and around the Aluminum Network cause technologies such as a floating road to diffuse while at other times they congest?

We continue this paper with a theoretical background on negotiation in networked innovation and introduce our framework for analyzing this process, after which we

present our empirical material and approach. The case helps to explain how innovation occurs from a negotiation processes perspective. We will conclude with a discussion that includes suggestions for further research, as well as (some) managerial and policy implications.

2. Theoretical background: Negotiation in networked innovation

Innovation processes have become increasingly decentralized (Gassmann & von Zedtwitz, 1998), distributed (Sawhney & Prandelli, 2000), open (Bercovitz & Feldman, in press; Chesbrough, 2003; Chesbrough et al., 2006) and/or networked (e.g. Hislop et al., 2000; Owen-Smith & Powell, 2005; Scarbrough & Swan, 2005; Tuomi, 2002). Organizations no longer rely on the possession and control of knowledge and skills in individuals and/or large R&D departments within their own organization. Instead, they have become dependent on other organizations for technological innovations, as well as for the diffusion and commercialization of these innovations (Calogherou et al., 2001; Poyago-Theotoky et al., 2002; Sawhney & Prandelli, 2000; Vanhaverbeke et al., 2002). An organization thus needs inter-organizational networks to innovate successfully. Although inter-organizational networks for innovation have not (yet) received as much attention as the R&D and knowledge generation activities in the academic literature, they are nevertheless important. In fact, these networks are crucial because they are directly responsible for market success and profitability of new technologies (Vanhaverbeke & Cloodt, 2006). As a result, organizations and governments initiate many types of collaborations (Calogherou et al., 2001; Corley et al., 2006; Siegel et al., 2003), clusters (Fromhold-Eisebith & Eisebith, 2005; Robinson et al., 2007), consortia (Link et al., 2002) and alliances (Bercovitz & Feldman, in press; Vanhaverbeke et al., 2002) to support effective networking in their (national) innovation system.

A concept that grasps the abovementioned development is networked innovation. We use the definition that Swan and Scarbrough (2005) propose, referring to Hardy et al. (2003: 323) to define networked innovation as a particular type of cooperation: *"innovation that occurs through relationships that are negotiated in an ongoing communicative process, and which relies on neither market nor hierarchical mechanisms of control"* (Swan & Scarbrough, 2005: 916). The idea of negotiation is

central in this definition. Negotiation is necessary because innovation takes place in a network, which differs from a market or hierarchy. In a network where partners with different backgrounds and interest are dependent on each other, innovations do not emerge and diffuse automatically, although literature has initially been quite positive: As knowledge is created and shared at the boundaries between cooperating organizations, in order to develop new products and services, networks are thus considered 'good for innovation'. These positive influences are particularly alleged and emphasized in literature that focuses on the structural aspects of networked innovation (Owen-Smith & Powell, 2005; Powell et al., 1996). This literature tends to see networks as vehicles for communicating and sharing of knowledge, and therefore spread of innovations, in a similar way as adoption literature underlines (Rogers, 2003). Some structures are considered better apt for sharing knowledge than others.

Currently however, the insight is growing that knowledge sharing among network members may not be as easy as often presented and assumed –as though it would naturally occur, as long as there is a structural infrastructure for it. Cognitive boundaries can play a role in obstructing or adjourning innovations (Ferlie et al., 2005). Also, differences in interests or opportunistic behavior can cause cooperative networks to fail before even achieving any innovation (Hamel, 1991). These insights have driven some researchers to emphasizing the processes that occur within the 'black box' of networked innovation (Hardy et al., 2003; Lounsbury & Crumley, 2007; Swan & Scarbrough, 2005; van de Ven et al, 1999). These researchers for instance emphasize the emergence of (new) social practices as the essence of innovation: *"innovations become innovations only when they start to play a role in this meaningful social practice"* (Tuomi, 2002: 11). Practice theory also teaches us that social practices are always embedded in social, institutional and political contexts (Philips et al., 2000). Central to these ideas is to study and analyze networked innovation in terms of behavioral dynamics and processes *inside* these embedded networks. Since networked innovation involves numerous decisions and negotiation events, performed by many people, spread over time and over different organizations (van de Ven et al., 1999), negotiation is a necessary process to take into account. Negotiation is *"a voluntary process of give and take where (all) parties modify their offers and expectations in order to come closer to each other"* (Ghauri, 1999: 3).

Whereas these recent literatures have emphasized the need for practice based research or even negotiation in relation to networked innovation, they have not yet developed a framework for analysis. We feel that such a framework, as developed in the next section, will enable the improved understanding of negotiation processes in networked innovation.

3. Developing a framework for negotiation in networked innovation

In order to understand the process of networked innovation, a process framework for analysis will be developed in this section that is able to analyze the complex nature of technological innovation by explicitly acknowledging and addressing its networked nature. The framework should enable to zoom in on the practices of networked innovation and negotiation. It is also important to take heterogeneity of the network into account, as these differences are often important sources of change and innovation (Swan & Scarbrough, 2005). As people begin to address their mutual tensions, as a result from differences in interests, goals, or unevenly divided resources, they may develop new priorities and begin to reconfigure their social environment. In this way they can come to develop new social practices (Tuomi, 2002). They address their tensions in negotiations, which are enabled by differences in available resources among actors involved and by the fact that the outcomes are uncertain (Wijen & Duysters, 2005). Power is thus an important aspect in negotiations: Networked innovation literature increasingly sees power as important aspect in networks, as there is no predetermined actor (organization) that determines the outcome of innovation endeavors (Beamish & Biggart, 2005; Scarbrough & Swan, 2005; Tuomi, 2002). Power is not only important however to get a fuller understanding of the dynamics *within* the network. Power relations with the wider environment in which networks are embedded also have a large influence on the process of change and innovation. Networked innovation thus *"involves sets of negotiations that are demanded by the lack of predefined institutional roles that accompany market- and authority-based relationships"* (Phillips et al., 2000).

3.1 Process of negotiation

As our central focus of research aims at innovation processes, a process theory is required that can inform us about such changes or transitions (Beamish & Biggart, 2005; Scarbrough & Swan, 2005; van de Ven et al., 1999). Networked innovation literature emphasizes the role of heterogeneous networks and their negotiations in innovation processes. Innovation takes place in negotiations among different actors in networks, who have different interests, often opposed, in terms of wanting (scarce) resources and having them available as sources of power. This makes the outcome of innovation processes uncertain beforehand, and enlarges the need to explore solutions. Recent innovation literature acknowledges that innovation comes about more disorderly, as processes of 'bricolage', rather than traditional linear models of innovation assumed (Garud & Karnøe, 2003; Smith et al., 2005). Innovation is thus a non-linear, unpredictable process (Tuomi, 2002). This could explain why *"the outcome of an innovation process may be neither optimal (…), nor 'satisfying'"* (Wijen & Duysters, 2005: 84).

Since it is often shaped by participants with opposing interests, we argue that a dialectic process approach is highly appropriate for understanding and explaining innovation as change process. The dialectic process theory assumes at least two entities that have opposed or contradictory interests (thesis vs. antithesis) (Van de Ven & Poole, 1995: 517). For instance, they can strive for the same scarce resources. Conflict follows, which needs to be resolved through negotiations between the players, eventually leading to a synthesis where they 'come together' (Ghauri, 1999). Synthesis can be a situation of consensus or when a new, common (social) practice is established, for example. Such a dialectic negotiation model, as illustrated in figure 1, fits the networked innovation process. Whereas a dialectic process approach is for instance applied in alliance theory (Das & Teng, 2000; De Rond & Bouchiki, 2004), it is not yet explicitly applied in networked innovation theory.

INSERT FIGURE 1 ABOUT HERE

3.2 Practice and negotiation

In order to analyze power aspects in negotiations among network members and consider the heterogeneity of these actors, we use Bourdieu's theory of practice (1977; 1984; 1990) to further develop our framework. His theory enables us to focus on what happens in these negotiation processes, as *"further investigation into the negotiated order within the 'black box' of technology seems to be necessary"* (Wijen & Duysters, 2005: 85). Although Bourdieu developed his theory for understanding culture and distinction of social groups within cultures, he provides certain concepts that can help with developing understanding of networked innovation processes.

Bourdieu refers to the social arena in which negotiations take place as '*field'*. A field can be defined at different levels, such as a project, a market, an industry, or a society. Within a field, different actors maneuver and negotiate with each other. They do this while coming from different backgrounds, reflected in speaking different languages, using different symbols, referring to different stories or having different goals and interests (Suddaby & Greenwood, 2005). Bourdieu refers to such a background as '*habitus'*, which can be understood as mental model (*"scheme of perceptions and beliefs"*) that shape actors' history (Bourdieu & Wacquant, 1992: 102). In a hospital for instance, doctors have a different habitus than nurses, resulting from differences in education, primary goal and professional background. Different actors are consciously and unconsciously shaped by their history and act on their interpretations of the world. As shown by Ferlie et al. (2005), such differences in habitus, as well as in interests, can lead to the non-spread of innovation in health care when social and cognitive boundaries prevent a synthesis.

Network members can use and develop various types of resources, or '*capitals'*, as sources of power within the negotiation process in a particular field. In general, a distinction is made between economic and intellectual capital. Economic capital consists of financial, physical and labor capitals. Intellectual capital is created by social capital, which consists of a relational, cognitive and structural dimension (Nahapiet &

Ghoshal, 1998). A particular type of capital, additional to economic and intellectual, is symbolic capital, which Bourdieu describes as the amount of honor and prestige possessed by a person with regards to acting structures. This is an important resource that is required to get legitimacy for any actions in a particular field. For instance, an academic degree can grant a doctor legitimacy in a hospital to perform certain procedures. Both opposing parties in a conflict, willing to resolve a conflict into a synthesis can use and develop all of these forms of capital. At the same time, they strive for capitals, in the form of (scarce) resources. This evokes negotiations among network members. The effect of a particular habitus and the structure and volume of capitals that actors possess, in relation to a larger force field they are embedded in, is referred to as '*practice'* (Bourdieu, 1977; Harker et al., 1995). As such, innovation can be considered as the process of change in (social) practices that is realized in a certain field where opposed parties, each with a different habitus, negotiate, while aiming at, using and developing various capitals.

3.1 Embeddedness perspective

As stated above, the field or arena where negotiations take place can be defined at different levels. These fields are nested as each field is embedded in a wider field, as practice theory implies. For instance, a particular project is embedded within a certain market, and that market is embedded within a society. This implies that within a particular field (level 1) opposed parties (thesis and antithesis) negotiate over a conflict, and eventually reach a synthesis. Together these parties can find themselves in another, wider embedded field (level 2). Here they can oppose a different party in turn, again forming thesis and antithesis in negotiations over a different conflict, eventually reaching a new synthesis (level 3). As a result, an embeddedness perspective on the fields where negotiations take place shows a recursive picture, as figure 2 shows. The framework for negotiation in networked innovation combines the dialectical process model with the concepts of field, habitus, and capitals, seen from an embeddedness perspective. Both are negotiation models, each showing different aspects of negotiation: Of the process of opposition until synthesis, and of the means that could be used in the power play, backgrounds that form them, and the arena where negotiations take place. In this way, they complement each other in the newly developed framework for

analyzing negotiation in networked innovation. In the remainder of this paper, a case study illustrates the conceptual use of this framework. In iteration between theory and this case, we have developed our framework as presented in figure 2.

INSERT FIGURE 2 ABOUT HERE

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4. Method

The data for our case study were collected from June 2005 until March 2007 and followed an inductive approach, aimed at building theory on negotiation in networked innovation (Eisenhardt, 1989; Siggelkow, 2007). Through an iterative process, we developed the framework that is presented above and will be discussed further in sections 5 and 6. The case is unique in the sense that we as researchers had access to follow a number of developments 'along the way', *while* they were happening –as opposed to innovation diffusion literature that often describes cases from decades ago: In the Netherlands, developments in infrastructure and construction in the area of water are extremely dynamic now, being a 'hot topic' that gets much (positive) political, policy and media attention. More specifically, we are able to zoom into negotiation processes that occur here. The access we have to the parties involved is very open while they were not previously disclosed. It can therefore be considered a revelatory case (Yin, 1994: 41). Moreover, the case presents a story of non-diffusing or adjourning networked innovation, which is not often described in literature –often focusing on best practices and successful diffusion.

As an embedded case study approach (Yin, 1994), our case study consists of seven cases that are related to the floating road. Our central case is that of Aluminum Network. Additionally, we included a case on one of the non-winning competitive networks within the floating road competition. Other additional cases consisted of five

initiatives in the same industry as the floating road concept, or institutional field, such as floating houses, floating glasshouses, and floating foundations (for building each of these constructions on it). These initiatives, led by entrepreneurs or networks, have developed alongside the floating road concept, in approximately the same period. For all of the cases we have studied piles of documents, such as reports, presentations, minutes, websites, and held in-depth interviews with key players about issues as the cooperation and negotiation processes, innovative concepts they develop, capitals used and developed in the negotiation processes. The interviews took place at the organization that each of the individuals worked for (which could give us a feel of their 'habitus') and/or during networking events where products were demonstrated. Such events also enabled us to observe the network(s), negotiations, and materials or concepts developed or under development. The interviews (approximately 35 hours in total) were all taped and fully transcribed in order to analyze further. We used the framework as a heuristic to give meaning to processes, structures and mechanisms. The documents and interviews were first used to construct a chronological description of the full innovation process, before developing the framework further. The results of the analysis are presented in the next section.

4.1 Introduction to the Floating Road case

In 1999 the Dutch governmental department of water management, hereafter denounced as 'Aqua-Gov', decided to fund a project within the context of a large innovation program that should solve infrastructural problems through designing, constructing and testing a floating road infrastructure. This project was the open design competition for a floating road. Through an innovative 'design and construct' contract (Beard et al., 2001), Aqua-Gov contracted Aluminum Network in a project that followed four phases: concept development, design development, construction, and testing. Afterwards the whole project was evaluated. Table 1 shows an overview of the timeline of the project. After the first phase, only three networks were selected to continue in the competition, and after the second phase only Aluminum Network continued. In-between each of the phases there was a long period of negotiations and contracting between Aluminum Network and their client Aqua-Gov.

INSERT TABLE 1 ABOUT HERE

We use three examples of negotiations in the case, which occurred at three different field levels. The first field level is that of the consortium Aluminum Network. Here, different Aluminum Network members strive and negotiate before reaching a synthesis in the Aluminum Network. This network is in turn in opposition to its client, Aqua-Gov at the second field level, that of the project (open design competition). Together they too reach a synthesis in that they develop a floating road. Finally, at the third field level, of the institutional field, the floating road strives with other contesters, concepts and initiatives that are in competition. Figure 3 illustrates how the framework as presented in figure 2 earlier is applied in the case. The next section discusses each of these field levels in detail, by using material from the case.

INSERT FIGURE 3 ABOUT HERE

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5. Results and analysis

In the following parts, three examples of negotiation processes are discussed, each located at a different field level, as shown in figure 3. Each fragment shows how capitals are used in these negotiation processes and how habitus is of influence to negotiations. Presenting it in this way does justice to the iterative process of analyzing the case and developing the framework. Afterwards, the findings are discussed in section 6.

5.1 Consortium field level: Via negotiation to synthesis of joint practices

The following fragment shows how participants of Aluminum Network, a consortium of six partners from different organizations, need to negotiate amongst each other in order to progress. The network members have different interests to defend, such as artistic appearances, commercial outlets, or political influence or status, and can find themselves, from time to time, in opposition. They strive for scarce resources within the project, such as funding, status, publicity, commercial leads, formal leadership. The latter is taken as an example of how they strive for scarce resources in the next fragment.

> The members of the Aluminum Network begin their first brainstorming session in phase I (concept development) of the project with a broad mind (*"it is irrelevant which material we will use; concrete, coated steel, aluminum"*), eager to use any possible material for the design of the road. At one point however, the one with the highest interests at stake in aluminum, 'Alu Inc.', forces the decision into using aluminum as their main material for the road. Such a movement to aluminum is obvious, since the Aluminum Network has previous experiences in designing and constructing with aluminum, mainly for the construction of bridges. At a later stage (phase II, design development), due to the interests and financial risks that are at stake in producing the necessary large amounts of aluminum, Alu Inc. becomes project leader throughout the remainder of the project. Since the network initiator of the project, 'Consult Inc.', has not contributed with financial/physical resources (economic capital), it has to resign its position as project leader at the moment that economic investments are required (phase II). This is the 'rule of the game' in (infrastructure) construction: The party that makes the highest investment or takes the highest risks (financially) gains formal power.

The above shows that physical capital, in terms of aluminum, helps Alu Inc. to gain formal leadership in the network, as a form of position/role taking. In order to win the competition (a first hurdle in the actual design and further commercialization), the material used for the road needs to be attractive in comparison to other contesters. Aluminum is considered such an 'attractive material', in terms of weight, aesthetics and

lifespan. However, the change of formal leadership within the consortium creates some challenges at later stages.

> Whereas Consult Inc. has an established relationship with the client, Alu Inc. is a newcomer in the field. Alu Inc. is mainly used to working for the military and oil and marine companies, but lacks relationships in the public sector, infrastructure or water management. The relationship between Aluminum Network and their client sometimes, during several phases of negotiations, faces difficulties because of this. As Aqua-Gov does not know what to expect from Alu Inc. and does not know whether they are a trustworthy partner, it informally regularly consults Consult Inc., to know how the project advances. Moreover, Alu Inc. is a different project leader than Consult Inc., who is known for taking care of work processes and communication. For instance, several times when Alu Inc. is invited for exhibitions or meetings to give a presentation about the floating road, they do not necessarily present it as a common Aluminum Network effort. Some network members express their discontent about the (lack of) communication: *"Alu Inc. were in it for themselves. (…) They often presented the road as something of themselves instead of of the consortium"*.
>
> Consult Inc. shows their discontent over the change of leadership and the consequences of that, by using 'negative' language to describe Alu Inc. The display of such language also occurs in conflicts over other issues besides formal network leadership, such as over performing certain tasks for funding: Whereas two partners in the consortium have the capabilities to perform certain calculations necessary to construct a safe road, only one of the members actually performs the task, again causing negative sentiments: *"Afterwards we are very happy that they got the job, because it had cost much more time and money, and it remains unclear whether they did a good job. The client was not happy with that"*.

The fragment shows that network members from time to time find themselves in opposition to each other. In order to be 'successful' negotiators, the participants can use

and develop different types of capitals. In the example, both the habit of the field (power for risk) and the importance of a winning design (by choice of material) causes that the economic capital of Alu Inc. prevails over their lack of social and symbolic capital, and over the capitals from other network members. Alu Inc.'s lack of social capital (relationships in the sector) however, causes a distrusting client, and its lack of symbolic capital (ability/willingness to communicate) causes distrusting network partners. In turn, Consult Inc. needs to maintain a good relationship with the client for the Aluminum Network. One of the reasons why Consult Inc. does this is because they want to win the competition, just like Alu Inc. has. So, whereas the network participants sometimes face differences to bridge and participate on their own behave, they have a clear common goal in mind while working on the project: They all want to be the first and only one to get the funding to build and sell a floating road. As such, they will all profit from positive attention and potential spillover effects, such as commercial leads to new activities or markets. Being aware of their complementarities and of their mutual goal, the network members form a team, reaching synthesis. Therefore, negotiations among the members are not as fierce as the negotiations with their environment: Their direct client and their wider environment, as we will discuss below.

5.2 Project field level: Habitus and contracting causing congestion

Since the design and construction of the floating road takes place within the format of an open design contest, the Aluminum Network is contracted for a particular assignment by Aqua-Gov as their formal client. Together they operate within the same field (the floating road project), but they each strive for the same resources within it, such as funding, knowledge and status/prestige. They each have their own ideas of what the project should deliver in the end and how they are able to achieve this. The Aluminum Network as a whole and their client Aqua-Gov can be considered as two opposed parties, client and contractor. Through a process of constant negotiation, they finally design and construct a particular *type* of floating road that can serve particular purposes and that has particular potentials. The following fragment illustrates how negotiations take place (in and between the different phases of the project) and how participants develop and use different capitals to reach their (individual) goals.

In the fragment, it will become clear that Aqua-Gov has formed a habitus that sometimes gets in the way of a fast development of the floating road. Their habitus (and lack of experience and intellectual capital) prevents them from successfully institutionalizing a new, innovative form of contracting: 'design and construct'. Traditionally, Aqua-Gov was used to formulating requirements for tenders as detailed as possible, in order for contractors to execute the work for them. As such, Aqua-Gov had full responsibility for the end-result. In the design and construct contract that is used in the floating road project, Aqua-Gov is supposed to give the contractor (Aluminum Network) full responsibility (paying them for the whole process instead of just for the product alone). Whereas Aqua-Gov only needs to deliver some guidelines and general requirements, the case shows that they want to interfere in the way they always did (habitus). This causes several tensions.

> During the project, the development costs are high and have to be carried by the Aluminum Network itself (in terms of time and research). At the same time, the client also pays for the project (in terms of material and Aqua-Gov personnel), resulting in that the network members should respond to the rules and requirements of Aqua-Gov. The precise division of risks and responsibilities is negotiated before the start of each new phase, resulting in a contract among the partners. Aqua-Gov does not to want to fail the innovation project in terms of bad publicity and spending too much money on research. They want to deliver a successfully tested prototype of a floating road (following their motto "long term thinking, short term doing"). In order to do so, Aqua-Gov wants to direct the outcome by controlling the process. Therefore, they repetitively introduce a number of complex requirements in relation to safety and stability measures. However, the Aluminum Network considers these requirements irrelevant, too strict and costly, feeling it is *their* responsibility to solve the issues within the boundaries of the assignment (instead of that of Aqua-Gov): *"the client demanded that if four hundred people were standing on one side, the road still needed to have a particular angle. Well, such a situation does not happen in normal life"*. Network members feel that the high requirements made the concept unnecessarily expensive, as well as less aesthetic, as it requires extra

> floating elements. In order to get Aqua-Gov to lower its requirements, the Aluminum Network often negotiates with Aqua-Gov: *"we have endlessly struggled, since they kept to their requirements"*. At one moment, the Aluminum Network can even use a contractual flaw in its negotiations in order to get Aqua-Gov to lower the requirements.

There are many examples of negotiations between the Aluminum Network and its client about how to divide responsibilities and risks. Through their habitus, both parties installed their own rules of the game, instead of developing new ones. In terms of capitals, we see that Aqua-Gov lacked knowledge and skills about how to implement and apply design and construct contracts (intellectual capital) as a new practice that the project required. Since Aqua-Gov was used to installing control mechanisms and applied this practice in this project too, they unwillingly/unconsciously adjourned the innovation process. They used their economic capital (funding the project) as important means in the negotiations. The following fragment shows how the Aluminum Network used particular capitals in the negotiations.

> In order to win the competition, for instance by being low-priced, aesthetic and of high quality, the Aluminum Network is able to benefit from its diverse composition. Whereas other networks in the competition consist of traditional combinations of contractors and builders, the Aluminum Network includes university professors and an architect. As a result, the network is able to provide colorful sketches of its design with creative details and aesthetic solutions of a flexible floating road construction that is easy to transport *and* includes a bridge. Aluminum Network displays creativity by its composition, its designs, and the look of its presentation materials. Such an image has positive consequences, as Aluminum Network wins the competition and is able to construct the road. Afterwards, competitors agreed that the Aluminum Network's design was indeed the best among the contesters: *"That road is really super-beautiful, with those aluminum shields, very architecturally sound and fantastic!"* (competing network participant).

Whereas Aqua-Gov primarily possessed economic capital (funding the winner), the Aluminum Network used its intellectual capital, social capital and symbolic capital. The network also had economic capital, in the form of the material they used. Jointly, the Aluminum Network members had experiences with building bridges of aluminum, which created their intellectual capital (primarily skills and knowledge) as well as relationships with each other and with external (market) parties (social, relational capital). In terms of symbolic capital, they used the creative image of professors and architects to their benefit. This not only enabled the network to create a 'more beautiful' design (through the specific intellectual capital of the participants), but Aluminum Network was also able to distinguish itself from the other contesters. Moreover, symbolic capital was created during the project, by developing attractive presentation material. Members of the network still use this capital every now and then when they are invited to give a presentation, for instance when they try to win a tender from competitive initiatives in the wider institutional field. The level of the wider institutional field, in which the project and Aluminum Network are embedded, is discussed in the following section.

5.3 Institutional field level: Devaluation of capitals

The third level at which negotiations take place during innovation processes is at the institutional field level. The process of constructing a floating road was embedded in a larger environment of (other) initiatives by networks and entrepreneurs who not necessarily situate themselves in the infrastructure sector, but also in multiple space use, construction and/or water management. They all constitute the wider institutional field. Since flood protection and multiple space use have become important policy issues in the Netherlands, initiatives are emerging. Parties are developing roads, greenhouses, villas, offices, expo centers, parking spaces, houses and other buildings in and on the water. Important developments also include the construction of 'floating foundations', on which all of these constructions can be built. Several entrepreneurs and networks have ambitions in this area. The fragment below shows how various parties at the institutional field level find themselves in opposition against each other, as competitors in an emergent market. Each of them wants its concept to be the first, the most

successful or most widely applied concept in this market. Currently, a fierce struggle has started among the various floating concepts.

> The floating road project started with the ambition to develop innovative infrastructure that could float and solve several problems simultaneously. At the same time, the project aimed to deliver a concrete prototype that obeyed all requirements (safety, image/applicability, and looks) and was not too expensive. But, as a separate road (not a whole infrastructure), without the parts that need to be connected (such as a house or parking space), the road became a competitor of existing Bailey bridges (portable prefab bridges) or floating pontoons for the army. Whereas the floating road was much better looking and had improved stability: *"This is much more comfortable. You can drive 80 km/h without noticing it. That's an improvement"* (scientist/architect), their comparatively high price, made it impossible to compete with the existing alternatives. Consequently, the road remains unused. Others notice this and draw their conclusions: *"Now their road lies within a shed, nobody is using it: That is not how we want it"* (other contestant). This induces them to stop the further development of a single road, but to focus on floating foundations, which could serve a larger market.

As a result of the floating road not being applied (yet) at a large scale, most actors that engage in this field of floating constructions, choose to develop other types of constructions than a floating road. Nevertheless, Aluminum Network members and external parties still use the floating road as an important means for communication in an emergent market, as the fragment below shows.

> Interestingly, in the struggle for constructing various floating concepts, every actor claims to be the first in something: Either in the design, in the use of certain technology or strategy, or in having the first prototype or real scale model. Many tend to downplay the other initiatives; sometimes they are bluntly negative about them. At other times, entrepreneurs are more careful and state that they are not aware of the other initiative, as it is not 'an interesting partner',

having no importance in the field: *"They scored one article in the newspaper with it, but we haven't heard from them since"*. So in order to develop symbolic capital in an emerging market, entrepreneurs use particular language to describe themselves and their competitors.

The road as constructed in this project is still the only one that exists, and it is often used in presentations, on websites and in reports or magazines: *"People regularly ask me to tell something about the floating road"* (former project leader). Even organizations that currently develop floating foundations, and were not directly involved with the floating road project, use pictures of the road on their website to attract (foreign) clients, as the road has a great power of expression. Apart from drawings of the design and pictures of the prototype, references to the road are also made in textual publications. In this way, the floating road is often applied. Additionally, it is beneficial for potential application of the road that a concrete prototype exists for people to experience: *"Not only to show our visualizations and nice talks, but that you can also have the idea of: feel it, stamp on it, and see if it rocks. You can all experience it yourself"*. Nevertheless, the road itself is currently stored away in a shed where it has lain unused for over three years.

Because of the (financial and time) restrictions of the project, it was not possible to develop a complete floating infrastructure, but only a part of a floating road. It therefore more resembled a bridge than a road, as it could only be used if it was connected to the shore. As the road was made of aluminum, a costly material compared to concrete or steel (at least in the short term), it was too expensive to make a larger road. However, as bridges actually already existed in cheaper forms, the current floating road was not an attractive alternative. It was neither an option to enlarge it into a complete infrastructure, as Aqua-Gov would be the one to pay for it. They did not want to (nor could) spend more money on it than they had already done in the context of the project. Additionally, Alu Inc., as the current owner of the floating road, lacks sufficient social capital in the form of being part of the infrastructure sector, to be able and willing to

spend sufficient time in introducing the innovation further: *"It is of course a total new market that needs to be targeted pretty strongly and intensively"* (Alu Inc.).

The above shows that if we look at the innovation from an institutional field level, the capitals that were used in the negotiations at a consortium or project field level had lost their value in the negotiations at the institutional field level. Whereas a creative image and a beautiful design enabled the Aluminum Network to proceed with their concept and win the contest, the same resources were useless in the competitive 'struggles' with other initiatives in a wider field. Here, a floating road (instead of a full infrastructure) could not fully compete with floating foundations.

6. Discussion and conclusions

The purpose of this paper was to develop a framework that improves our understanding of the process of technological innovation diffusion (or temporary non-diffusion or adjournment) when perceived as a negotiation process among heterogeneous network participants. The importance of networks for innovations, and the heterogeneous character of those networks have raised the need to take embeddedness and negotiation aspects into account. The framework integrates a dialectical process approach with a practice based negotiation approach. The concepts of (embedded) fields, habitus and (economic, intellectual and symbolic) capitals help to provide a terminology with which an embedded process of networked innovation could be described and understood. At each field level, parties strive with each other as a result of opposite interests or aims, based on differences in habitus, and manifesting in negotiations. By zooming in at the negotiation practices between the various actors, we show that important reasons for adjournment of networked innovation can be found here: When power balance is unequal or a network member lacks (valuable) capital, when there is a lack of shared understanding in terms of a common habitus, or when there are differences in interests in a field, congestion can emerge. As such, the framework illuminates reasons why innovative concepts sometimes do not (yet) diffuse, or 'congest', in a particular environment.

Our research shows that negotiations occur at different (embedded) field levels. Within each level, several actors find themselves in opposition and use a number of capitals in negotiations, before reaching a synthesis. Between the different levels, these capitals can devaluate or gain value however, as at different levels other capitals are considered more important. In relation to path dependency, the dynamics of networked innovation is primarily explained through negotiation processes at the individual field level. However, exceeding the individual field level, taking embeddedness into account, innovation does not always follow and can be adjourned. Decisions are made (in negotiations) that are 'logical' within the particular individual field, but are less so when taking into account the wider field levels in which the negotiations are embedded. The networks within the open design competition that had more valuable social capital than Alu Inc. in the Aluminum Network, in terms of links with the market for a floating road, would have had better opportunities to market the concept. Such social capital however, was not as important as economic capital, taking the habitus of the industry into account. Therefore, Alu Inc. and the Aluminum Network won the competition, but were unable to further diffuse their innovative concept. As such, the case illustrates the unpredictable and whimsical course of the networked innovation process when analyzed from a negotiation perspective, taking different levels and differences in background and interest into account. These insights imply valuable contributions to existing theory.

6.1 Theoretical implications

Our first contribution to innovation theory is that we have developed a negotiation perspective on innovation processes in a network context. We have developed a framework for describing, analyzing and understanding negotiation in networked innovation. Whereas innovation diffusion literature traditionally has focused primarily on either agency and/or adoption (Beise, 2004; Rogers, 2003), or structure and/or institutionalism (Dacin et al., 2002; DiMaggio & Powell, 1983; Scott, 2001), we assemble with those scholars who acknowledge the need for a combination or integration (Garud et al., 2002; Greenwood & Suddaby, 2006; Lounsbury & Crumley, 2007). Within this current stream, we specifically focus on synthesis and power play in the negotiation processes at different levels, as innovation increasingly comes about in heterogeneous networks in which participants are interdependent and where

negotiations are required. We used an embedded case study to further develop the framework (Eisenhardt, 1989). Our research shows that innovation diffuses in an 'illogical' manner when considered at various field levels, but can be understood from a negotiation perspective, which is in line with and contributes to Wijen and Duysters (2005) and Swan and Scarbrough (2005). (Differences in) habitus and the availability of capitals can evoke conflicts and negotiations, which in turn can cause innovation to congest, as the case of the floating road accurately shows.

A second contribution of our research is the understanding that various capitals in negotiations have different value at different levels in embedded fields. By applying the framework to our case we have shown that a particular (amount of) capital that is used as power source at one level proves useless, or at least powerless, at another level. This is well illustrated in the example of the relational dimension of social capital. Since at a wider field level, new parties and networks are competitors or find themselves in opposition, this requires new coalitions each time. As our case shows, at the consortium field level (field 1), the participants of the Aluminum Network negotiate among each other, whereas they form a coalition against their client in the negotiations at the project field level (level 2). Simultaneously, both the Aluminum Network and their client can form a bloc towards other innovative initiatives they meet at the institutional field level (level 3). A coalition in multiparty negotiations can be defined as: *"Two or more parties who cooperate to obtain a mutually desired outcome that satisfies the interest of the coalition rather than those of the entire group within which it is embedded"* (Polzer et al., 1998: 42). Such forming of coalitions ('us versus them') is particularly common in multiparty negotiations, of which networked innovation is an example. So taking an embedded field perspective, we were able to see how networked innovation is influenced by the need to develop and use different types of capitals for negotiations at different levels.

Finally, our research contributes to existing literature in that it shows how innovations (and changes in social practices) are legitimized or not (Eriksson 2007; Hargrave & van de Ven, 2006; Suddaby & Greenwood, 2005) via the use of symbolic capital. The floating road case shows that symbolic capital is often used, for instance in the form of

language, artifacts or composition of the network, as a source of power in the negotiation process. In order for a network to proceed in a contest for example, it needs to show its client that its ideas have value for money. The Aluminum Network uses forms of symbolic capital, such as beautiful presentations and tries to outsmart competition by using negative or even foul language when describing them. This mechanism is in line with recent results of Theoharakis et al. (in press), who found that printed media (as a form of symbolic capital) on emerging technologies can influence the diffusion process of competing technologies. Symbolic capital is particularly powerful, as it 'mediates' in the growth and application of the other forms of capital; intellectual, social and economic. For instance, since the image of creativity (symbolic capital) could cause the Aluminum Network to win the competition, members formed a network that consisted of architects and scientists (social capital). Our research fits the suggestions of Deroïan (2002) that the formation of social networks (social capital) might play a role in the (non)diffusion of innovations. Our case provides some empirical illustrations of such a mechanism, and shows the interrelatedness with other forms of capital as well. Moreover, the importance of such intangible, hybrid capitals (not always measurable) (Dean & Kretschmer, in press) as symbolic capital is even more important when negotiations in networked innovation is about concepts (instead of new products) that are developed. This would make the importance of symbolic capitals even higher than products (physical capital also important).

6.2 Managerial and policy implications

An important management implication of our research is that organizations, networks and policy need to acknowledge and consider the negotiation aspects of networked innovation process. Such acknowledgement takes away the false thought that innovation emerges and diffuses in a 'understandable' (linear, rational) way, and that networks are 'always good'. Instead, it enables the understanding that certain decisions can lead to *"a non-linear, unpredictable process"*, that is neither optimal, nor satisfying (Wijen & Duysters, 2005: 84). When taking into account the embedded nature of fields, and negotiation processes in relation to innovation, it becomes clear which mechanisms lie beneath diffusion or adjournment. Concepts of habitus, fields and capitals can help in perceiving and analyzing these mechanisms.

While many governments stimulate innovation by initiatives such as pilot projects (Calogherou et al., 2001; Link et al., 2002), science parks (Siegel, Westhead & Wright, 2003) or triple helix collaborations (Leydesdorff & Meyer, 2006; Santoro & Gopalakrishnan, 2001), important is to realize that the moment the field level changes, new capitals come into play. Moreover, capitals can devaluate or gain value when considered at a different field level, but often, they were used to base decisions on at a particular field level. Each field level thus puts different requirements to capitals and involves different actors with whom negotiations take place. This implies that capitals either need to be developed within the original field or that time needs to be reserved to do it afterwards. For instance, in pilot projects, one might want to spend time on developing social capital (building relations with the right partners) within the project, before the further diffusion and commercialization of the innovative concept takes place. What happens if the government withdraws its funding after a pilot project is finished? Will parties grow more dependent on their interests and habitus? And, needless to say, economic capital is not the only capital of importance in this respect.

6.3 Limitations and future research

There are several limitations to this research. Because the field of networked innovation is still under development, as it is only recently explicitly recognized in the literature, our research, which focused on negotiation, has an explorative character. We build a conceptual framework, illustrate its use and further develop it by studying (embedded) cases in the field of infrastructure construction. This field is a particular one in the sense that the government has a special role: It is both initiator of (innovation) projects, partner in those projects, and client of these projects. Commercialization of innovations in this field has a particular character in this respect (Hall et al., 2000; Voordijk et al., 2000). Moreover, the construction sector also has a particular structure (as well as habitus) that might prevent innovation in networks to take place often/successfully (Dubois & Gadde, 2000). Therefore, it would be very valuable and interesting to test our framework in more and different environments, industries or countries, at a larger scale. For instance in the medical sector, where the need to innovate is particularly high (Djellal & Gallouj, 2005; Metcalfe et al., 2005).

Additionally, we have only briefly commented on the functions of symbolic capital as a particular form of capital. The examples from our case show that the symbolic component of negotiations is very important in terms of getting ideas or concepts accepted and legitimized in a certain (sub)field. This can be achieved by using a particular language (being negative about 'the other'), image (pictures, presentations) or network (types of people, status). After the construction fraud affair in the Netherlands for example, the industry is often considered as a non-trustworthy partner, at least for many governmental organizations. Therefore, several industrial partners participate in funded research networks with universities. This provides them the legitimacy of being trustworthy with governmental organizations: *"I sometimes sell myself to the outside world as part of our company, and sometimes as part of the research network. Then you are independent, not aimed at profits and more aimed at knowledge creation. That is totally different, and makes a huge difference to the government"* (other contestant). This implies that 'being part of a research network' can also be considered important symbolic capital through which social capital can be created. It would be interesting to develop greater understanding of the role of symbolic capital in the negotiations for further diffusing innovations. In particular, it would be a valuable path to study the role of symbolic capital in the process of project marketing (Skaates, Tikkanen & Alajoutsijärvi, 2002; Skaates, Tikkanen & Lindblom, 2002): How can organizations learn from their projects, and how can they build on and capitalize from them, both in terms of intellectual and economic capital and symbolic capital?

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Figure 1. Dialectic process approach (van de Ven & Poole, 1995: 520)

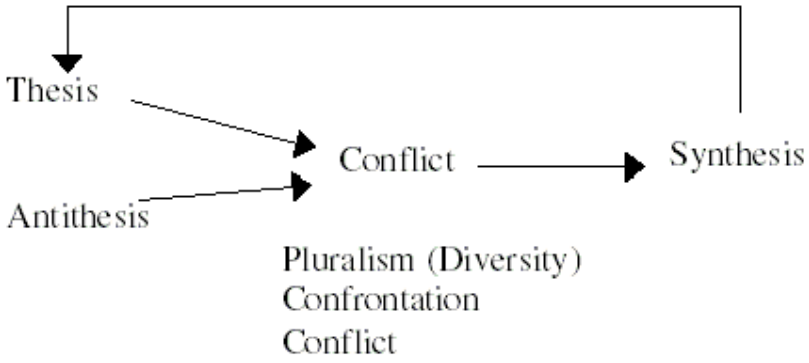

Figure 2. Networked innovation: A framework

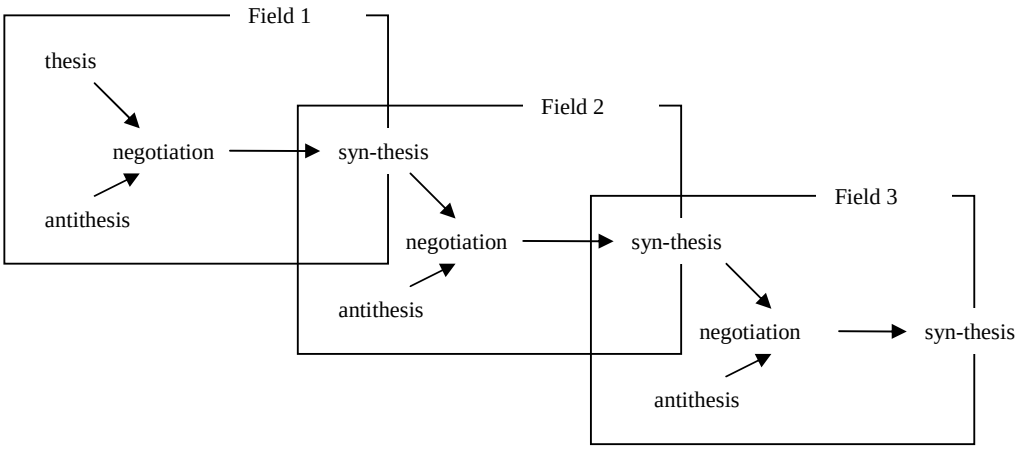

Figure 3. Networked innovation: The case of a 'floating road'

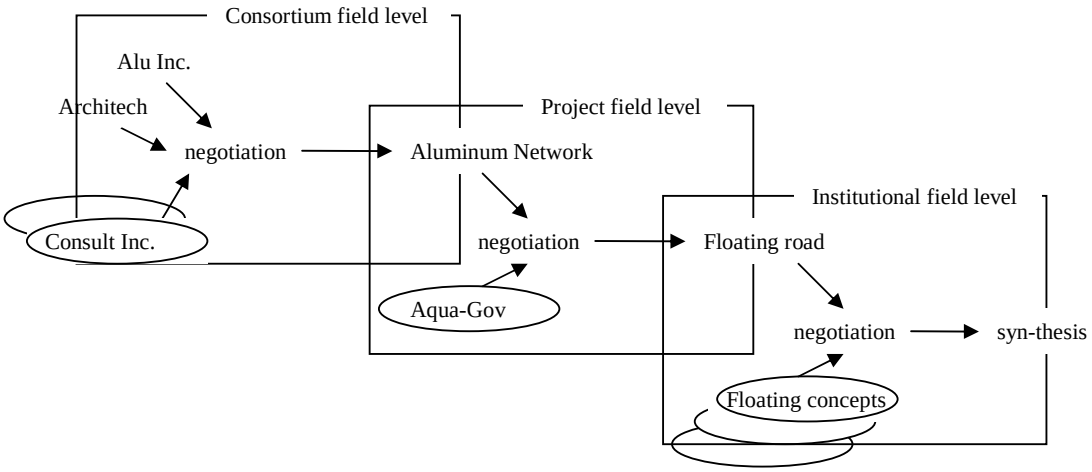

Table 1. Time plan of the 'floating road' project

1999	*2000*	*2001*		*2002*	*2003*		*2004*	*2005-2007*
Pre phase	**Phase I**		**Phase II**		**Phase III**	**Phase IV**	Post phase	
Feasibili-ty study	Concept develop-ment	Negotia-tions	Design develop-ment	Negotia-tions	Constru c-tion	Testing	Evalua-tion	